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F3C CFJ
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(56) Documents cited

GB 2228067 A	GB 2202614 A	GB 1590145 A
GB 1354307 A	GB 1062205 A	US 4819610 A
US 3921614 A	US 3863887 A	US 3495580 A

(58) Field of search
UK CL (Edition K) F3C CFJ
INT CL[5] F41B

(54) Valve for a pneumatic firearm

(57) The autocharging, self regulating, stepdown pressure, precision pulse discharge gas valve, automatically primes and accurately controls the ballistic pressure delivery of pneumatically precharged, high pressure air pistols and rifles.

Movement of a trigger releases valve 3 to cause pressurized air from firing chamber 4 to be released via port 5 to push a projectile along the barrel. On release of pressure from chamber 4 dual diameter piston of a regulator valve moves towards release valve 3 to allow simultaneous charging of chamber 4 from an intermediate chamber and opening of throttle valve 7 to permit air from the high pressure chamber to re-charge the intermediate chamber. When the pressure in chamber 4 reaches a pre-set level piston 6 reverses its movement to close the valves. This process is repeatable as long as the chamber 8 is at a higher pressure than the required firing pressure.

The valve comprises component parts which screw together to form the complete valve, allowing ease of disassembly for servicing and replacement of worn or damaged parts.

The valve can be adjusted to give a range of ballistic pressures to suit projectile size, range and muzzle velocity requirements.

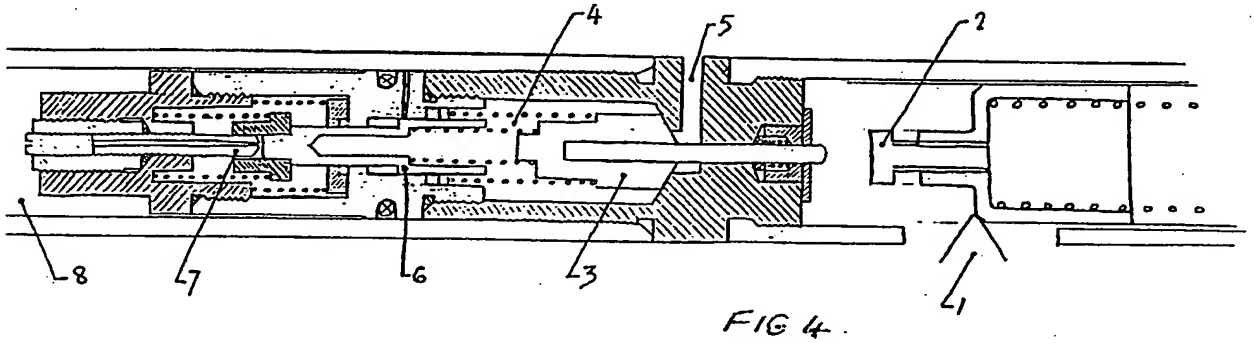

FIG 4.

GB 2 258 913 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

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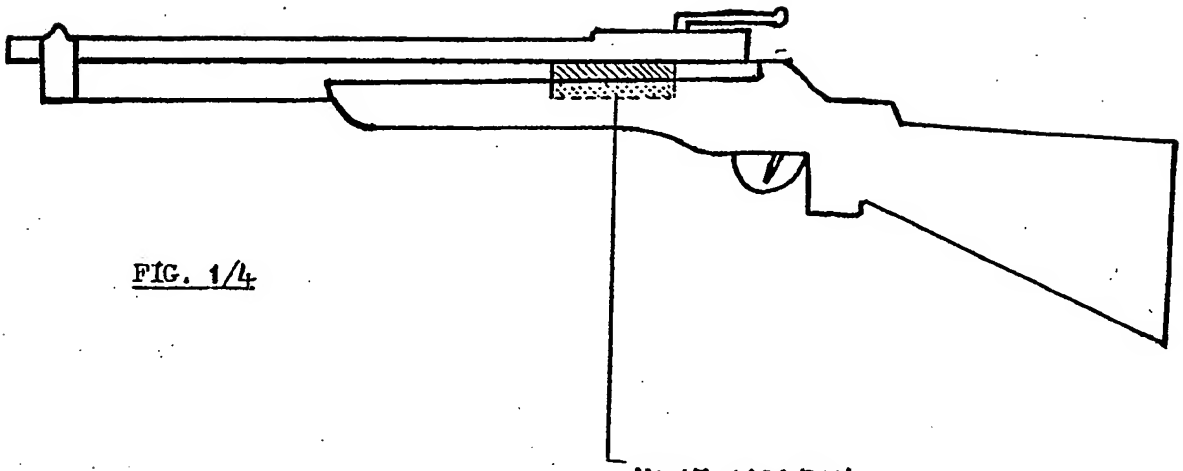


FIG. 1/4

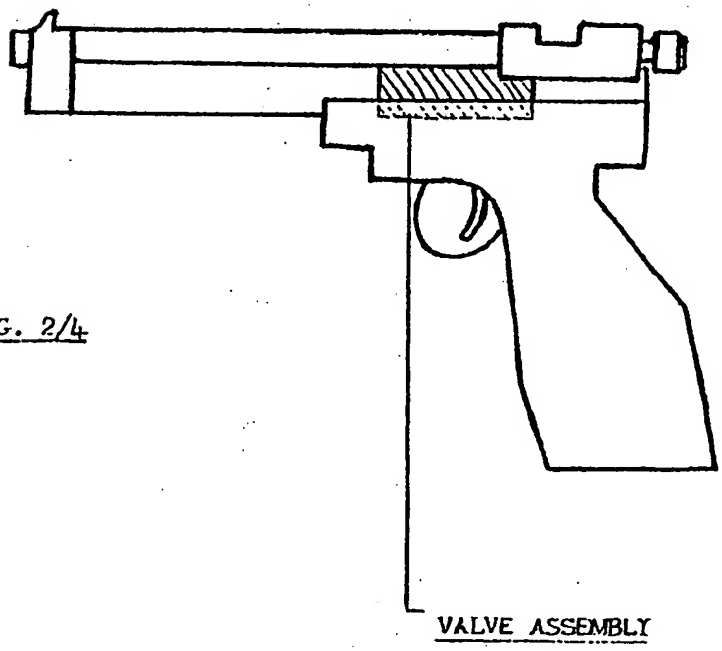
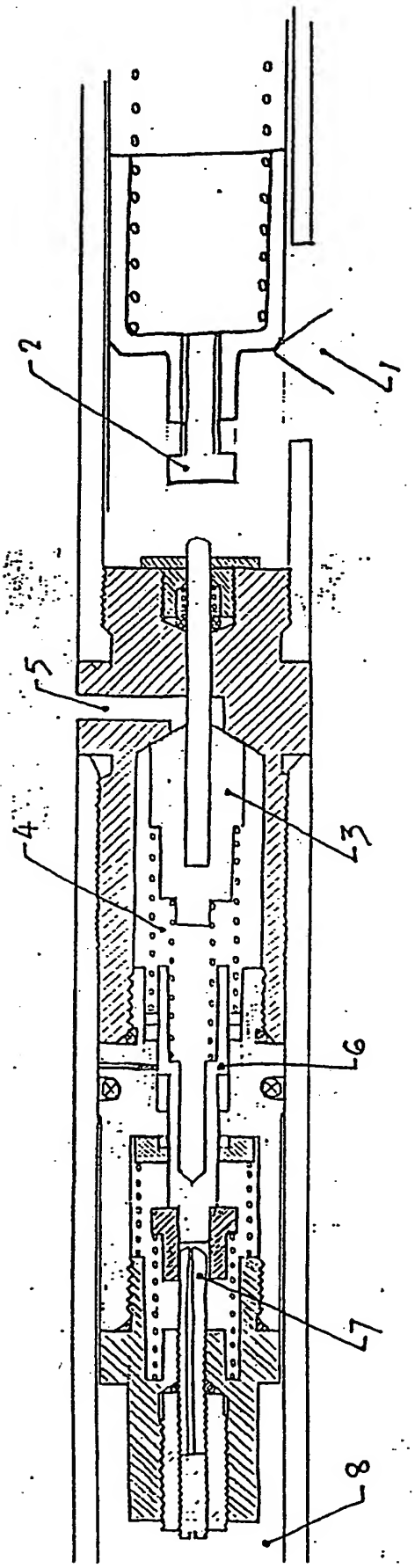


FIG. 2/4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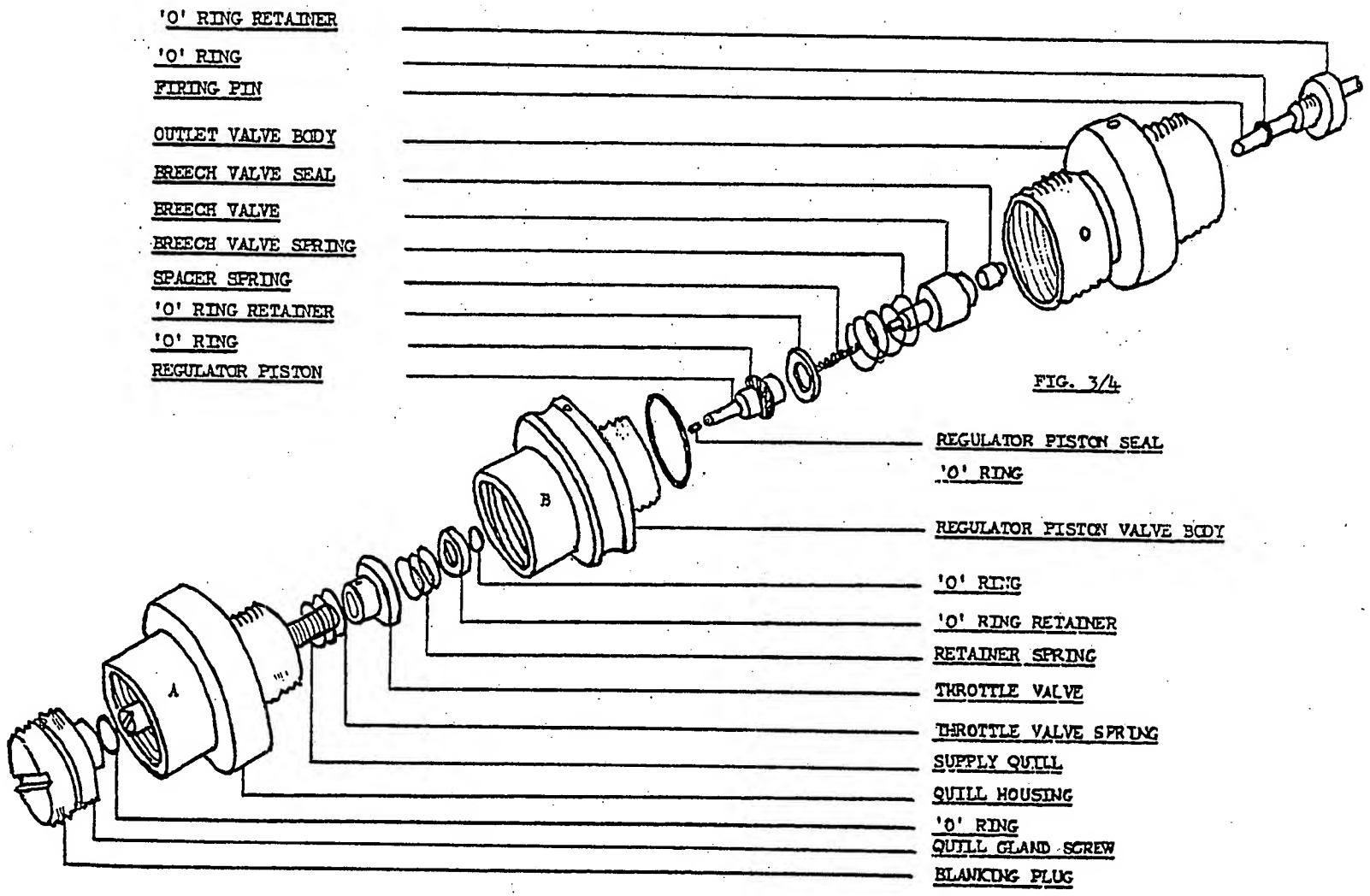
'O' RING RETAINER
'O' RING
FIRING PIN
OUTLET VALVE BODY
BREECH VALVE SEAL
BREECH VALVE
BREECH VALVE SPRING
SPACER SPRING
'O' RING RETAINER
'O' RING
REGULATOR PISTON
REGULATOR PISTON SEAL
'O' RING
REGULATOR PISTON VALVE BODY
'O' RING
'O' RING RETAINER
RETAINER SPRING
THROTTLE VALVE
THROTTLE VALVE SPRING
SUPPLY QUILL
QUILL HOUSING
'O' RING
QUILL GLAND SCREW
BLANKING PLUG
A
B

FIG. 3/4

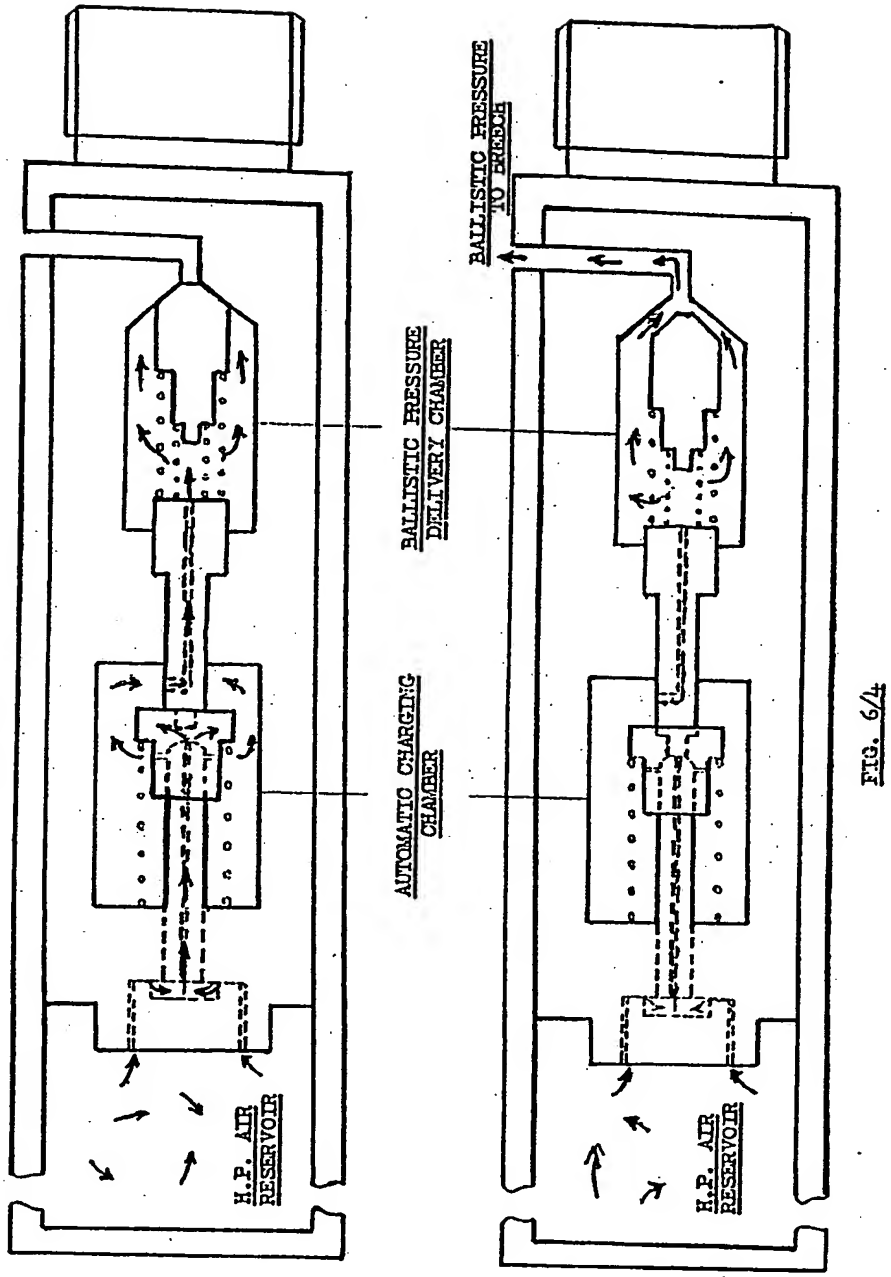
BALLISTIC PRESSURE TO BREECH
BALLISTIC PRESSURE DELIVERY CHAMBER
AUTOMATIC CHARGING CHAMBER
H.P. AIR RESERVOIR
H.P. AIR RESERVOIR

FIG. 5/4

FIG. 6/4

PNEUMATIC PISTOL AND RIFLE, AUTOCHARGING, SELF REGULATING, STEPDOWN PRESSURE, PRECISION PULSE DISCHARGE GAS VALVE

This invention relates to a regulator valve, which automatically recharges and accurately controls the ballistic pressure of pneumatically precharged high pressure air pistols and rifles.

The valve is operated by the high pressure reservoir supply, simultaneously regulating down the discharge pressure to a predetermined value, for each firing pulse, each subsequent discharge being identical to its predecessor, irrespective of fluctuating or falling bulk reservoir pressure.

The valve provides consistent ballistic pressures to the pistol or rifle breech, prior to each firing, allowing projectile trajectories to be constant.

Consistent ballistic pressures can be predetermined by adjustment of the high pressure nozzle quill to suit different target ranges and muzzle velocity requirements.

Pneumatically powered pistols and rifles require the storage of compressed air, instantaneously released, to provide the ballistic energy to eject the projectile, at high velocity, from the gun barrel.

The trajectory behaviour of the projectile entirely depends upon the compressed air ballistic force behind its delivery; varying ballistic pressures produce varying projectile trajectories, requiring manual compensation to maintain consistent point contact with the target.

Precharged pneumatic weapons rely upon a charged reservoir of high pressure air (2000 - 6000 psi), released in lower pressure pulses (ballistic pressure), to provide multiple firings from one single reservoir high pressure charge.

Existing precharged pneumatic weapons utilise a regulating valve which throttles down the high pressure reservoir air pressure to a lower pressure suitable for the ballistic force, but need operator attention to manually reset the regulator valve in preparation for the next firing, firstly, to recharge the delivery chamber, and secondly, to adjust the ballistic pressure to approximate that of the preceeding charge.

The operation of pneumatic weapons with existing regulator valves require extensive operator skill in setting, and compensating for, the varying ballistic pressures for each pulse reload.

According to the present invention, the autocharging, self regulating, stepdown pressure, precision pulse discharge valve, automatically recharges the delivery chamber to a preset, non variable, ballistic pressure, allowing each delivery pressure pulse to be exactly the same for each firing, irrespective of falling or fluctuating pressure in the high pressure supply reservoir.

This precision control is effected by the regulator piston incorporated within the valve.

Ballistic pressure remains at a fixed value for each firing. The valve is integrally incorporated within the pneumatic system of the pistol/rifle, component parts assembled along a common centreline axis to provide an uninterrupted linear gas flow, the assembly of each component part incorporating 'O' rings between sealing faces to prevent internal leakage, each component valve body fixed to the others via screw threads to facilitate ease of disassembly for servicing and damaged/worn part replacement.

The valve assembly comprises of three main valve body housings which, when screwed together, form three interconnected gas tight chambers; the high pressure chamber, the automatic charging chamber and the pre-regulated ballistic pressure delivery chamber.

The high pressure chamber houses the adjustable high pressure gas supply quill, the automatic charging chamber houses the throttle valve interconnected; via the regulator piston, to the ballistic pressure delivery chamber, housing, the firing pin released, breech supply valve.

The valve instantaneously meters high pressure reservoir gas through the chambers finally storing gas at a precision controlled, predetermined pressure until it is to be released to the breech as propellant.

The valve utilises internal gas pressures as the forces to overcome mechanical spring forces locating the regulator piston in its housing, differential pressures, acting on the annular surface areas of the regulator piston end faces, control the movement of the regulator piston through its stroke. Linear movement of the regulator piston opens the preset high pressure supply port, instantaneously priming the ballistic pressure delivery chamber to the required ballistic pressure, at which time, the regulator piston movement is reversed, by differential pressures, to close off the high pressure supply and seal in the ballistic pressure charge pulse ready for use. The weapon is charged for firing.

The process will be precision repeated after firing, (i.e. the release of ballistic pressure), until reservoir gas pressure falls to that required as ballistic pressure.

The reservoir may then be recharged to its full pressure by external means (e.g. high pressure pump or air bottle), the valve then able to continue its precision control of ballistic pressures, identical to those for the previous reservoir charge.

A specific embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which,

Fig. 1/4 shows the installation location of the valve within a rifle.

Fig. 2/4 shows the installation location of the valve within a pistol.

Fig. 3/4 shows in isometric, exploded view the component parts of the valve.

Fig. 4/4 shows in sectional detail the full assembly of the valve.

Fig. 5/4 shows in schematic layout, the gas flow paths through the valve when charging.

Fig. 6/4 shows in schematic layout, the gas flow path through the valve when the weapon is fired.

The complete valve is installed within the high pressure reservoir tube, the complete assembly mounted directly below the gun barrel and locating in the weapon stock. Fig. 1/4 and Fig. 2/4.

The reservoir tube is closed at one end by the inlet valve, (connected to a high pressure pump or air bottle when reservoir recharging is required), the installation of the precision discharge valve, closing and sealing the other end of the reservoir tube.

The ballistic pressure exit port is machined in the outlet valve body and is directly connected to the breech of the barrel located directly above.

The valve comprises of three (3) main valve bodies A, B, and C, housing the internal components as shown in Fig. 3/4.

The common axis assembly of all three valve bodies, constituting the complete valve outer housing, creates three (3) individual gas tight chambers, interconnected via the movements of the, internally located, regulator piston and breech valve, designated X, Y and Z chambers in Fig. 4/4.

Referring to Fig. 4/4, high pressure air is confined within reservoir X at a charged pressure of between 2000 - 6000 psi, depending on the charging facilities on site. (Charge may be from compressed air bottles or pump). Air is stored at this pressure within the reservoir by the provision of an 'O' ring seal, fitted to valve body B external diameter and the regulator piston closing off the high pressure port of the supply quill.

Pressure, (ballistic pressure), previously supplied at the previous charging, resides in chamber Z, its force on the annular surface area of the regulator piston face, (exposed in chamber Z), overcoming pressure differentials and spring rates, to abutt the high pressure supply quill nozzle, closing off the supply.

At trigger operation the firing pin pushes the breech valve off its seat releasing the pressure trapped in chamber Z.

This ballistic pressure is suddently released to the breech propelling the projectile along the barrel, Fig. 6/4.

Virtually instantaneously, the firing pin retracts, allowing the breech valve to return to its closed position resealing chamber Z.

High pressure reservoir air continuously bleeds past the blanking plug screw threads, via the blanking plug and gland screw interfaces, (screw slot), through the quill nozzle to await release into chamber Y (the automatic charging chamber).

The sudden release of pressure from chamber Z effects immediate movement of the regulator piston towards the breech valve, caused by differential pressures in chambers X and Y, this movement of the regulator piston uncovering the quill nozzle port.

Chamber Y is thus charged with high pressure air feeding and modulated by restrictors (throttle valve), through the centre of the regulator piston to pressurise chamber Z, Fig. 5/4.

As the pressure in chamber Z approaches its predetermined pressure value, the regulator piston reverses its stroke, via pressure equilibrium forces, to seal off chamber Z trapping in the required ballistic pressure, simultaneously, closing off the high pressure quill port.

At this point chamber Y and chamber Z are atequal pressures.

The system is again charged to the precise ballistic pressure ready for firing.

Air, at atmospheric pressure, trapped behind the shoulder of the regulator piston, is bled out to atmosphere through a cross drilling in valve body B, escaping via the external screw threads of valve body C.

The ballistic pressure, determining projectile trajectory, range and muzzle velocity, can be preset by adjusting the depth of penetration of the high pressure supply quill into chamber Y.

The greater the quill penetration into chamber Y, less force is required to compress the throttle valve retaining spring and the smaller the travel by the regulator piston to close off the high pressure supply quill nozzle. Consequently, a lower ballistic pressure in chamber Z is determined.

Conversely, retraction of the quill, requires greater force to compress the throttle valve retaining spring, demanding a larger stroke by the regulator piston establishing a higher ballistic pressure setting.

The quill nozzle is provided with fine screw threads along its length allowing a considerable range of ballistic pressures to be selected.

Once selected, the ballistic pressures will remain constant and precisely consistent for the life of the valve.

CLAIMS

1) Pneumatic pistol and rifle, autocharging, self regulating, stepdown., precision pulse discharge gas valve.

2) The valve is self regulating,giving constant pressure within the secondary / operating chamber.

3) The pressure within the valve can be adjusted within the range of 200 to 2300 pounds per square inch.

4) The secondary / operating chamber is automatically re-charged from the main cylinder to the pre-set pressure, while ever the pressure in the main cylinder exceeds the set pressure of the secondary / operating chamber.

5) The valve operates on a precision pulse re-charge.

6) By using a dual diameter piston in the valve light spring pressures can be used to overcome the air pressure difference between the main cylinder and the secondary / operating chamber.

7) The valve is fitted with an atmospheric bleed for safety, and preventing secondary / operating chamber overcharge.

Patents Act 1977

Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

9110680.7

Relevant Technical fields

(i) UK Cl (Edition K) F3C CFJ

(ii) Int CL (Edition 5) F41B

Databases (see over)

(i) UK Patent Office

(ii)

Search Examiner

PAUL GAVIN

Date of Search

30 APRIL 1992

Documents considered relevant following a search in respect of claims SEE LETTER

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2228067 A (BUBB) Whole document	1 at least
X	GB 2202614 A (PAGE) Whole document	1 at least
X	GB 1590145 (OLOFSSON) Whole document	1 at least
X	GB 1354307 (SGL INDUSTRIES) Whole document	1 at least
X	GB 1062205 (DAISY MAN CO) Whole document	1 at least
X	US 4819610 (ETAT FRANCAIS) Whole document	1 at least
X	US 3921614 (FOGEL GREN)	1 at least
X	US 3863887 (STRADELLA)	1 at least
X	US 3495580 (DE MARE)	1 at least

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Category	Identity of document and relevant passages	Relevant to claim(s)

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